

WHAT IS CLAIMED IS:

- 1                   1.       A method for lung volume reduction, said method comprising:  
2                   isolating a lung tissue segment;  
3                   reducing gas flow obstructions within the segment; and  
4                   aspirating the segment to cause the segment to at least partially collapse.
- 1                   2.       A method as in claim 1, wherein reducing gas flow obstructions  
2                   comprises inflating the lung tissue segment to a pressure higher than its normal inflated  
3                   pressure.
- 1                   3.       A method as in claim 2, further comprising deflating adjacent lung  
2                   regions while the lung tissue segment is inflated.
- 1                   4.       A method as in claim 2, wherein inflating the lung tissue segment  
2                   comprises positioning a catheter in an air passage leading into the segment, inflating a  
3                   balloon on the catheter to seal the air passage, and introducing a gas through the catheter  
4                   to inflate the segment.
- 1                   5.       A method as in claim 1, wherein reducing gas flow obstructions  
2                   comprises introducing an agent to the lung tissue segment, wherein the agent clears or  
3                   dilates air passages within the segment.
- 1                   6.       A method as in claim 5, wherein the agent is selected from the  
2                   group consisting of mucolytic agents, bronchodilators, surfactants, desiccants, solvents,  
3                   necrosing agents, perfluorocarbons, and absorbents.
- 1                   7.       A method as in claim 5, wherein introducing the agent comprises  
2                   positioning a catheter in an air passage leading to the segment and delivering the agent  
3                   through the catheter to the segment.
- 1                   8.       A method as in claim 1, wherein reducing gas flow obstructions  
2                   comprises delivering mechanical energy to the lung segment.
- 1                   9.       A method as in claim 8, wherein the mechanical energy is  
2                   vibrational energy.

1                   10.     A method as in claim 8, wherein the vibrational energy is delivered  
2 by inflating the segment with a non-compressible fluid and ultrasonically exciting the  
3 fluid to distribute ultrasonic energy throughout the segment.

1                   11.     A method as in claim 1, wherein isolating the lung tissue segment  
2 comprises positioning a catheter in an air passage leading to the lung tissue segment and  
3 inflating a balloon on the catheter to occlude the air passage.

1                   12.     A method as in claim 11, wherein aspirating comprises drawing  
2 gas and liquids present from the isolated lung segment through a lumen in the catheter  
3 while the balloon remains inflated.

1                   13.     A method as in claim 12, wherein aspirating is performed at a  
2 negative pressure in the range from 2 mmHg to 50 mmHg.

1                   14.     A method as in claim 1, further comprising sealing an air passage  
2 which opens to the lung tissue segment to inhibit reinflation of the segment.

1                   15.     A method as in claim 14, wherein sealing comprises deploying a  
2 plug in the air passage.

1                   16.     A method as in claim 15, wherein the plug is swellable and absorbs  
2 water to swell within the air passage when deployed.

1                   17.     A method as in claim 16, wherein the plug comprises a collagen  
2 hydrogel which is not fully hydrated prior to deployment.

1                   18.     A method as in claim 14, wherein sealing comprises introducing a  
2 plug and an adhesive in the air passage.

1                   19.     A method as in claim 18, wherein the adhesive includes a  
2 radiopaque tracer.

1                   20.     A method for lung volume reduction, said method comprising:  
2 isolating a lung tissue segment;  
3 aspirating the isolated segment to cause the segment to collapse; and  
4 applying external pressure to the isolated segment.





- 1                   44.     A method as in claim 43, wherein the sealing step is reversible.
- 1                   45.     A method as in claim 43, wherein sealing comprises deploying a  
2 plug in the air passage.
- 1                   46.     A method as in claim 45, wherein the plug is swellable and absorbs  
2 water to swell within the air passage when deployed.
- 1                   47.     A method as in claim 46, wherein the plug comprises a collagen  
2 hydrogel which is not fully hydrated prior to deployment.
- 1                   48.     A method for lung volume reduction, said method comprising:  
2 isolating a lung tissue segment;  
3 aspirating the isolated segment to cause the segment to collapse, wherein  
4 the segment is collapsed to a volume which is no greater than 40% of the inflated size  
5 prior to aspiration.
- 1                   49.     A method as in claim 48, further comprising insufflating the  
2 isolated lung tissue segment with substantially pure oxygen to promote absorption  
3 atelectasis prior to aspirating.
- 1                   50.     A method as in claim 48, wherein isolating the lung tissue segment  
2 comprises positioning a catheter in an air passage leading to the lung tissue segment and  
3 inflating a balloon on the catheter to occlude the air passage.
- 1                   51.     A method as in claim 50, wherein aspirating comprises drawing  
2 gases and liquids present from the isolated lung segment through a lumen in the catheter  
3 while the balloon remains inflated.
- 1                   52.     A method as in claim 48, further comprising sealing an air passage  
2 which opens to the lung tissue segment to inhibit reinflation of the segment.
- 1                   53.     A method as in claim 52, wherein sealing comprises deploying a  
2 plug in the air passage.
- 1                   54.     A method as in claim 53, wherein the plug is swellable and absorbs  
2 water to swell within the air passage when deployed.

1                   55.     A method as in claim 54, wherein the plug comprises a collagen  
2 hydrogel which is not fully hydrated prior to deployment.

1                   56.     A system for performing intraluminal lung volume reduction, said  
2 kit comprising:  
3                   an isolation/access catheter having a proximal end, a distal end, an  
4 occlusion element near the distal end, and at least one lumen extending therethrough;  
5                   a sealing catheter having a proximal end, a distal end, and  
6                   a closure element carried by the sealing catheter;  
7                   wherein the sealing catheter may be introduced through the lumen of the  
8 isolation/access catheter and the closure element may be deployed from the sealing  
9 catheter.

1                   57.     A system as in claim 56, wherein the closure element comprises a  
2 swellable plug.

1                   58.     A system as in claim 56, wherein the isolation/access catheter  
2 includes at least two lumens extending therethrough.

1                   59.     A system as in claim 58, wherein the isolation/access catheter  
2 further including a fiber optic scope and a light source disposed to permit forward  
3 viewing.

1                   60.     A system for performing intraluminal lung volume reduction, said  
2 kit comprising:  
3                   an isolation/access catheter having a proximal end, a distal end, an  
4 occlusion element near the distal end, and at least one lumen extending therethrough; and  
5                   a reagent capable of being introduced to the lung through the  
6 isolation/access catheter lumen, wherein said reagent will clear or widen air passages  
7 within the lung.

1                   61.     A system as in claim 60, wherein the reagent is selected from the  
2 group consisting of mucolytic agents, bronchodilators, surfactants, desiccants, solvents,  
3 necrosing agents, perfluorocarbons, and absorbents.

1                   62.     A system as in claim 60, wherein the isolation/access catheter  
2 includes at least two lumens extending therethrough.

1                   63.     A system as in claim 62, wherein the isolation/access catheter  
2 further includes a fiber optic scope and a light source disposed to permit forward viewing.

1                   64.     A system for performing intraluminal lung volume reduction, said  
2 kit comprising:

3                   an isolation/access catheter having a proximal end, a distal end, an  
4 occlusion element near the distal end, and at least one lumen extending therethrough; and  
5                   a probe which can be percutaneously introduced into a pleural region over  
6 the lung, said probe being capable of applying external pressure to the lung.

1                   65.     A system as in claim 64, wherein the probe has an inflatable  
2 balloon which engages a surface of the lung.

1                   66.     A system as in claim 64, wherein the probe has a non-inflatable  
2 atraumatic end which engages a surface of the lung.

1                   67.     A system as in claim 64, wherein the isolation/access catheter  
2 includes at least two lumens extending therethrough.

1                   68.     A system as in claim 67, wherein the isolation/access catheter  
2 further includes a fiber optic scope and a light source disposed to permit forward viewing.

1                   69.     A kit comprising:  
2                   an isolation/access catheter capable of being introduced transtracheally  
3 into the air passages of the lungs; and  
4                   instructions to introduce the isolation/access catheter to a target region of  
5 the lungs and to aspirate an isolated tissue segment according to claim 1.

1                   70.     A kit as in claim 69, further comprising a sealing catheter, wherein  
2 said instructions further set forth that an air passage leading to the isolated tissue segment  
3 is to be sealed using the sealing catheter after the region has been aspirated.

1                   71.     A kit as in claim 69, further comprising means for applying  
2 external pressure to the lung at the same time the lung is being aspirated.

1                   72.     A kit as in claim 69, further comprising an agent which clears or  
2 widens air passages in the lungs when introduced into the lungs prior to aspiration.

1                   73.     A kit as in claim 72, wherein the agent is selected from the group  
2 consisting of mucolytic agents, bronchodilators, surfactants, desiccants, solvents,  
3 necrosing agents, perfluorocarbons, and absorbents.

1                   74.     A kit comprising:  
2                   an isolation/access catheter capable of being introduced transtracheally  
3 into the air passages of the lungs; and  
4                   instructions to introduce the isolation/access catheter to a target region of  
5 the lungs and to aspirate an isolated tissue segment according to claim 20.

1                   75.     A kit as in claim 74, further comprising a sealing catheter, wherein  
2 said instructions further set forth that an air passage leading to the isolated tissue segment  
3 is to be sealed using the sealing catheter after the region has been aspirated.

1                   76.     A kit as in claim 74, further comprising means for applying  
2 external pressure to the lung at the same time the lung is being aspirated.

1                   77.     A kit comprising:  
2                   an isolation/access catheter capable of being introduced transtracheally  
3 into the air passages of the lungs; and  
4                   instructions to introduce the isolation/access catheter to a target region of  
5 the lungs and to aspirate an isolated tissue segment according to claim 31.

1                   78.     A kit as in claim 77, further comprising a sealing catheter, wherein  
2 said instructions further set forth that an air passage leading to the isolated tissue segment  
3 is to be sealed using the sealing catheter after the region has been aspirated.

1                   79.     A kit as in claim 77, further comprising means for applying  
2 external pressure to the lung at the same time the lung is being aspirated.

1                   80.     A kit as in claim 77, further comprising an agent which clears or  
2 widens air passages in the lungs when introduced into the lungs prior to aspiration.



1                   81.     A kit as in claim 80, wherein the agent is selected from the group  
2 consisting of mucolytic agents, bronchodilators, surfactants, desiccants, solvents,  
3 necrosing agents, perfluorocarbons, and absorbents.

1                   82.     A kit comprising:  
2                   an isolation/access catheter capable of being introduced transtracheally  
3 into the air passages of the lungs; and  
4                   instructions to introduce the isolation/access catheter to a target region of  
5 the lungs and to aspirate an isolated tissue segment according to claim 48.

1                   83.     A kit as in claim 82, further comprising a sealing catheter, wherein  
2 said instructions further set forth that an air passage leading to the isolated tissue segment  
3 is to be sealed using the sealing catheter after the region has been aspirated.

1                   84.     A kit as in claim 82, further comprising means for applying  
2 external pressure to the lung at the same time the lung is being aspirated.

1                   85.     A kit as in claim 82, further comprising an agent which clears or  
2 widens air passages in the lungs when introduced into the lungs prior to aspiration.

1                   86.     A kit as in claim 85, wherein the agent is selected from the group  
2 consisting of mucolytic agents, bronchodilators, surfactants, desiccants, perfluorocarbons,  
3 and solvents.

1                   87.     A method for evacuating air from a region of a lung, said method  
2 comprising:  
3                   introducing a low molecular weight gas to a region, wherein the region  
4 collapses as the low molecular weight gas is absorbed into the blood stream.

1                   88.     A method as in claim 87, wherein the low molecular weight gas is  
2 helium.

1                   89.     A method as in claim 88, wherein the helium is present in a  
2 mixture with oxygen.

1 90. A method for lung volume reduction, said method comprising:  
2 isolating a lung tissue segment;  
3 determining a disease-related parameter within the isolated segment;  
4 aspirating the segment to cause the segment to at least partially collapse;  
5 and  
6 temporarily sealing a lung passage leading to the isolated segment.